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ABSTRACT

This digest presents a summary discussion of the value of holding science fairs in the elementary school context. Reasons for conducting science fairs for elementary students are discussed in terms of several learning theories. Developmentally appropriate types of elementary science projects are suggested. Goals for elementary school science fairs and a suggested science fair time table are listed. A list of Internet resources related to science fairs is also included. (WRM)

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Science fair projects have long been familiar events in schools throughout the country, and they have come to represent science in action, science as inquiry. The investigatory aspect of science fair projects fits well with current reform efforts guided by such publications as *Science for All Americans*, *Benchmarks for Scientific Literacy*, and the *National Science Education Standards*. Classroom science is steadily being transformed into a process-driven, inquiry-based area of study, and science fair projects provide additional opportunities for students to become personally and directly involved in scientific investigation.

Elementary schools participate in science fairs for a variety of reasons: to stimulate student interest in science, to provide students with opportunities for research and active inquiry, to publicly recognize students' completed projects, and to provide students with opportunities to share their work (Perry,1995). There are many variations in format, but the primary components of a science fair project typically include an investigation, a written research report, a visual display, an oral presentation, and some sort of assessment. Learning some scientific facts or principles is a valuable fringe benefit for students doing projects, but the primary objective for science project work is to teach students to think (Tant, 1992, p.5.)

Students participating in science fairs are doing more than learning something new; they are using and extending knowledge gained previously through other experiences. Science fair work plans help students organize and review background information gained through previous library research on topics of interest. Past experiences will also help students make decisions on the importance of information to their topics.

The more a student knows about a topic, the easier it is to learn and remember new information (Recht & Leslie, 1988, as cited in Bruning, et al., 1995). Science fair projects provide students another avenue of learning more about topics of personal interest to them while also demonstrating both factual knowledge in written reports and procedural knowledge through the research process itself (Bruning, et al, 1995). Together, prior knowledge and newly acquired knowledge enable students to generate, analyze, and assess the impact of their findings, as well as connect what they learn to experiences beyond the science fair project.

Developmental and Knowledge Levels

The operational stages defined by Piaget's theory of cognitive development largely influence the types of science fair projects that elementary school students can be expected to conduct (Piaget,1969, as cited in Bruning, et al.,1995). Examples of appropriate projects include: (a) demonstratons of practical products such as cameras; (b) creation of models to show how natural phenomena, such as the water cycle, work; (c) illustrations of scientific concepts, such as magnetism, and how they relate to experienced phenomena; (d) collections that display and compare variations in objects, such as insect collections; and (e) investigations that show the effects of changes in treatment on systems, such as the effects of nutrients on plant growth (Perry, 1995.)

Educational goals in elementary classrooms encompass students' social, personal, attitudinal, and cognitive development. In the social domain, science fair projects help students become responsible and purposeful. Science fair projects also foster development of a student's sense of personal capabilities and qualities. Additionally, science fair projects help students develop an appreciation for nature and the relevance of science in daily life, thereby promoting positive attitudes toward science. But the primary focus of science fair projects is on fostering the cognitive and intellectual development of students.

Participation in science fairs contributes to learning within the

The goals for science in elementary school and science fairs include the following:

- Increased skill in making thoughtful, accurate observations.
- Increased skill in forming reasoned and appropriate hypotheses.
- Increased skill in identifying assumptions and differentiating assumptions from facts.
- Increased skill in making comparisons and in identifying similarities and differences.
- Increased skill in classifying objects and in creating categories in which various items may be ordered.
- Increased skill in gathering data and making meaningful interpretations of data.
- Increased skill in making decisions based on reasoned deliberation and thoughtful consideration of alternatives.
- Increased skill in creating, imagining, and inventing.
- Increased ability to tolerate uncertainty.
- Increased skill in designing projects and experiments to test hypotheses.
- Increased ability to formulate and raise questions about phenomena.
- Increased understanding of core scientific concepts.
- An increased knowledge base with respect to scientific information

(Wassermann & Ivnay,1996, pp. 65-66).

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constructivist framework: students build on prior knowledge by gaining and using new information through their reading, observations, and experimentation. Collaborative interactions with peers, mentors, parents, and their teacher also enhance the experience. As Vygotsky has proposed (1979, as cited in Bruning, et al.1995) in his theory of the "zone of proximal development," the interaction between a novice and an expert can bring the novice to a higher level of accomplishment than the novice could expect to reach on his or her own. One role for teachers in science fair projects, then, is to engage students in the process of seeking and gaining knowledge, a reflective process that is enhanced through interactions teachers, peers, and materials.

Suggested Science Fair Time Table

Date	Activity
Week 1	Science fair is announced to students.
	Students brainstorm science fair ideas.
	Students form interest groups.
	Groups begin to plan research projects.
Week 2	Groups complete research proposal forms.
Week 3	Groups work on reports, presentations, and displays.
Week 4	Groups refine work on their reports, presentations, and displays.
Week 5	Groups present science fair projects.

A Broader Context for Learning

Learning is influenced by a person's level of self-esteem and belief in his or her ability to learn. Bandura (1986, as cited in Bruning, et al. 1995) presents learning as being influenced by three components: the personal beliefs of learners, their behaviors, and the environment. Further, the behavior of each learner is influenced by his or her sense of self-efficacy, the level of confidence one has in his or her ability to achieve success. The sense of self-efficacy is usually domain specific; a student who excels in art, for instance, may have a lower sense of self-efficacy in science. Even within a specific domain of success, a student may not believe he or she can achieve success in a particular setting. For example, a student who earns an "A" on a science exam may not believe that he or she will do well in a science fair.

So, science fairs provide another context for learning science; students have an opportunity to go beyond the planned science curriculum to pursue individual interests and talents, and to examine practical problems with hands-on activities that link science with other facets of the curriculum. Science fairs provide students with opportunities to reflect and make sense of their total educational experience. (American Association for the Advancement of Science, 1993)

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Science Fair Resources on the Internet

There are a variety of valuable resources on the World Wide Web to support science fairs and projects. The sites listed here are selected samples of those available.

Science Fair Primer
http://www.capecod.net/~trowan/primer.htm
This primer is written to help students develop science fair projects and is based on over twenty years of teaching science through research projects.

Science Projects
http://www.minnetonka.k12.mn.us/support/science/lessons45/sciencefair.html
This document is for parents and describes what science fair projects are and how to assist students with projects.

Science Fairs
http://physics.usc.edu/~gould/ScienceFairs/
This is a comprehensive listing of all the known science fairs accessible on the World Wide Web, from international events to local fairs.

Cyberspace Middle School
http://www.scri.fsu.edu/~dennisl/
This site includes a variety of useful resources for students, teachers, and parents who are involved in science fair projects.

Eduzone Showboard
http://www.eduzone.com/tips/science/kit2.htm
Offers a practical guide to science fair projects, from idea to exhibit.

Franklin Institute Acience Activities
http://sln.fi.edu/tfi/activity/act-summ.html
Provides an extensive list of projects categorized by grade level (K-8)

Science Fair Idea Exchange
http://www.halcyon.com/sciclub/cgi-pvt/scifair/guestbook.html
Students post science fair projects they have done or ideas they have had about projects. A good place for ideas.

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